IN THE CLAIMS:

Claim 1 (Currently Amended): A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved through an annealing process comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature, wherein the step of lowering the temperature comprises:

decreasing the temperature inside said container to a second temperature, which is in the range of around 600 °C to 900 °C at a rate of 2 °C/hour or less, and then

decreasing the temperature inside said container from said second temperature to room temperature,

wherein

the first temperature is between 1020 °C to 1150 °C.

Claim 2 (Currently Amended) A manufacturing method according to claim 1, wherein the step of lowering the temperature comprises decreasing the temperature from said second ~~first~~ temperature to room temperature at a rate of 2 °C or less.

Claim 3 (Cancelled)

Claim 4 (Currently Amended) A manufacturing method according to claim 1 ~~3~~, wherein the step of lowering the temperature comprises decreasing the temperature from 44said second temperature to room temperature at a rate of 5 C°/hour or less.

Claim 5 (Currently Amended): A manufacturing method according to claim 1, wherein a single crystal of calcium fluoride with a diameter of ø 200 mm or greater, which can be used in an optical system for photolithography, ~~can be~~ is obtained.

Claim 6 (Currently Amended): A manufacturing method according to claim 5, wherein a single crystal of calcium fluoride with a difference in the refractive index, Δn, equal to 2×10^{-6} or less ~~can be~~ is obtained.

Claim 7 (Currently Amended): A manufacturing method according to claim 5, wherein a single crystal of calcium fluoride with a double refraction value, in a direction of the axis of light, of 2 nm/cm, or less ~~can be~~ is obtained.

Claim 8 (Currently Amended): A manufacturing method according to claim 5, wherein a single crystal of calcium fluoridewith a double refraction value, in an off-axis direction perpendicular to the axis of light, of 5 nm/cm or less ~~can be~~ is obtained.

Claim 9 (Currently Amended): A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said first container and the temperature inside said second container to room temperature, wherein the step of lowering the temperature comprises:

decreasing the temperature inside said first container and the temperature inside said second container to a second temperature, which is in the range of around 600 °C to °900 C, at a rate of 2 °C/hour or less, and then

decreasing the temperature inside said first container and the temperature inside said second container to room temperature,

opening the inside of said first container to a normal atmosphere

wherein,

the first temperature is between 1020 °C and 1150 °C.

Claim 10 (Currently Amended) A manufacturing method according to claim 9, wherein the step of lowering the temperature comprises decreasing the temperature from said second ~~first~~ temperature to room temperature at a rate of 2 °C/hour or less.

Claim 11 (Cancelled)

Claim 12 (Currently Amended): A manufacturing method according to claim ~~9~~11, wherein the step of lowering the temperature comprises decreasing the temperature from said second temperature to room temperature at a rate of 5 °C /hour or less.

Claim 13 (Currently Amended): A manufacturing method according to claim 9, wherein a single crystal of calcium, fluoride with a diameter of 200 mm or greater, which can be used in an optical system for photolithography, ~~can be~~ is obtained.

Claim 14 (Currently Amended): A manufacturing method according to claim 13, wherein a single crystal of calcium fluoride with a difference in the refractive index, Δn, equal to 2×10^{-6} or less ~~can be~~ is obtained.

Claim 15 (Currently Amended): A manufacturing method according to claim 13,

wherein a single crystal of calcium fluoridewith a double refraction value, in the direction of the axis of light, of 2 nm/cm or less ~~can be~~ is obtained.

Claim 16 (Currently Amended): A manufacturing method according to claim 13, wherein a single crystal of calcium fluoridewith a double refraction value, in the off-axis direction perpendicular to the axis of light, of 5 nm/cm or less ~~can be~~ is obtained.

Claims 17-20 (cancelled)

Claim 21 (Currently Amended): A manufacturing method for a single crystal of calcium fluoride according to claim 1, ~~having its optical properties improved comprising the steps of:~~

~~providing a single crystal of calcium fluoride in a sealable container, sealing said container, then~~

~~heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,~~

~~maintaining the temperature inside said container at said first temperature for a designated period of time,~~

~~lowering the temperature inside said container to room temperature,~~

wherein,

said sealable container is filled with an inert gas, and the inside of said container is maintained at an atmosphere of approximately 1 atm such that said single crystal of calcium fluoride is not oxidized.

Claim 22 (Currently Amended): A manufacturing method for a single crystal of calcium fluoride according to claim 9, ~~having its optical properties improved comprising the steps of:~~

~~providing a single crystal of calcium fluoride and fluorination agent in a second container arranged in a sealable first container, sealing said first container, then~~

~~heating said first container with a heater arranged external to said first container such that the temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,~~

~~maintaining the temperature inside said second container at the first temperature for a designated period of time,~~

~~lowering the temperature inside said second container to room temperature, and~~

~~opening the inside of said first container to a normal atmosphere,~~

wherein,

at a minimum, in order to prevent oxidation of said single crystal of calcium fluoride during the process, the process is carried out such that said fluorination agent is vaporized and becomes a fluorine gas atmosphere inside of said second container, while a pressure inside said first container is maintained at approximately 1 atm.

Claim 23 (Original): A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

maintaining said single crystal of calcium fluoride at a maximum first temperature which is within the range of 1020 °C to 1150 °C for a designated period of time, and

lowering the temperature of said single crystal of calcium fluoride to a second

temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

Claim 24 (Original): A manufacturing method according to claim 23, wherein the step of lowering the temperature comprises decreasing the temperature from said second temperature to a third temperature, which is in the range of around 400 °C to 600 °C, at a rate of 3 °C/hour or less.

Claim 25 (Original): A manufacturing method according to claim 24, wherein the step of lowering the temperature comprises decreasing the temperature from said third temperature to room temperature at a rate of 5 °C/hour or less.

Claim 26 (Previously Amended): A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at the first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature, which is between 1020 °C and 1150 °C, is lowered to a second temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

Claim 27 (Original): A manufacturing method according to claim 26, wherein the step of lowering the temperature comprises decreasing the temperature from said second temperature to a third temperature, which is in the range of around 400 °C to 600 °C, at a rate of 3 °C/hour or less.

Claim 28 (Original): A manufacturing method according to claim 27, wherein the step of lowering the temperature comprises decreasing the temperature from said third temperature to room temperature at a rate of 5 °C/hour or less.

Claim 29 (Currently Amended): A manufacturing method according to claim 26, wherein a single crystal of calcium, fluoride with a diameter of ⌀ 230 mm or greater, which can be used for the optical system for photolithography, ~~can be~~ is obtained.

Claim 30 (Currently Amended): A manufacturing method according to claim 29, wherein a single crystal of calcium fluoride with a difference in the refractive index, Δn, equal to 2×10^{-6} or less ~~can be~~ is obtained.

Claim 31 (Currently Amended): A manufacturing method according to claim 29, wherein a single crystal of calcium fluoride with a double refraction value, in a direction of the

axis of light, of 2 nm/cm or less ~~can be~~ is obtained.

Claim 32 (Currently Amended): A manufacturing method according to claim 29, wherein a single crystal of calcium fluoride with a double refraction value, in the off-axis direction perpendicular to the axis of light, of 5 nm/cm or less ~~can be~~ is obtained.

Claim 33 (Previously Amended): A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at said first temperature for a designated period of time,

lowering the temperature inside second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C, and

the temperature is decreased from said first temperature to a second temperature, which is in the range of around 600 to 900 °C, at a rate of 1.2 °C/hour or less.

Claim 34 (Original): A manufacturing method according to claim 33, wherein the step of lowering the temperature comprises decreasing the temperature from said second temperature to a third temperature, which is in the range of around 400 to 600 °C, at a rate of 3 °C/hour or less.

Claim 35 (Original): A manufacturing method according to claim 34, wherein the step of lowering the temperature comprises decreasing the temperature from said third temperature to room temperature at a rate of 5 °C/hour or less.

Claim 36 (Currently Amended): A manufacturing method according to claim 33, wherein a single crystal of calcium fluoridewith a diameter of ⌀ 230 mm or greater, which can be used for the optical system for photolithography, ~~can be~~ is obtained.

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Claim 37 (Currently Amended): A manufacturing method according to Claim 36, wherein a single crystal of calcium fluoride with a difference in the refractive index, Δn, equal to 2×10^{-6} or less ~~can be~~ is obtained.

Claim 38 (Currently Amended): A manufacturing method according to Claim 36, wherein a single crystal of calcium fluoride with a double refraction value, in a direction of the axis of light, of 2 nm/cm or less ~~can be~~ is obtained.

Claim 39 (Currently Amended): A manufacturing method according to Claim 36, wherein a single crystal of calcium fluoride with a double refraction value, in the off-axis

direction perpendicular to the axis of light, of 5 nm/cm or less ~~can be~~ is obtained.

Claims 40-42 (cancelled)